Data Transmission Issues

TOPIC 2 – TRANSMITTING DATA

UNIT 1 – INFORMATION TECHNOLOGY SYSTEMS

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Data Transmission Issues

Other than security issues another is speed of transmission.

Data needed to be transmitted as quickly as possible

factors include both hardware and software

Data Transmission Issues

BANDWIDTH & LATENCY

COMPRESSION

CODECS

Bandwidth

- Amount of data that can be transferred from one computer to another in a given period of time.
- Measured in megabits per second.
- A high bandwidth is better as you can transfer more bits of data per second.

Latency

- Measure of the time it takes for a data packet to transfer over a network.
- Measured in milliseconds.
- A low latency is better as the data can reach its destination faster.

Compression

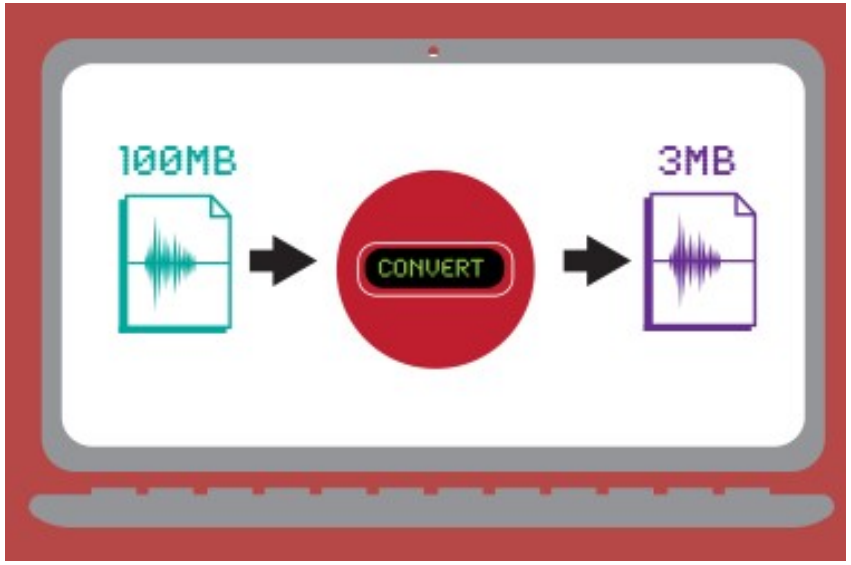
Compression allows us to reduce the number of bits needed to represent data

For reducing file size.

less bandwidth will be required to transmit the data

Two major types of compression.

- **Lossy Compression** – It permanently deletes certain bits of data to reduce file size.
- **Lossless Compression** – It uses algorithms to pack the data into less space.



Codecs

Hardware CODECs

- Encode analogue data into digital data
- Then decode the digital data into an analogue form.

Software CODECs

- Uses audio and video data in order to compress the data so that it can be transmitted.
- Audio and video data is often large and so compressing it is important

Notes & Activities – 20 mins

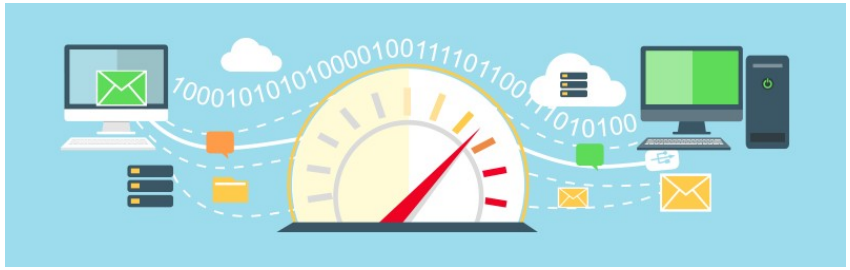
1. Look through additional slides in the PowerPoint on Data Transmission Issues

2. Add **additional** notes for each Data Transmission Issues**- 2 Bullet Points minimum**

3. Add **1 additional advantage** and **1 disadvantage** for each Data Transmission Issues

4. Complete the **3 Activities** for **each** Data Transmission Issue

Bandwidth & Latency



The bandwidth of a network is the amount of data that can be transferred from one computer to another in a given period of time. This is measured in bits per second, or more commonly, megabits per second. A high bandwidth is better than a low bandwidth as you can transfer more bits of data per second.

The latency of a network is a measure of the time it takes for a data packet to transfer over a network. This is measured in milliseconds. A low latency is better as the data can reach its destination faster.

We sometimes refer to latency as the network ‘ping’, however, there is a slight difference. The ping is the time it takes for the data packet to travel over a network to the destination and back to you.

We often only think of bandwidth when thinking about network speed, but increasing your bandwidth might not help network performance if your latency is poor. Let’s explain this with an analogy.

Increasing your bandwidth would be like adding lanes of a motorway. The more lanes you have the more cars (or data packets) you can transfer at once. However, the latency is like the speed limit of that motorway. It doesn’t matter how many cars can travel at the same time if the fastest they can travel is 10mph.

There are some types of network traffic that are more reliant on bandwidth than latency and vice versa. For example:

Bandwidth & Latency - Activity

Can you think of any other examples where either a high bandwidth or a low latency is required?

What about video calls or cloud-based software? Do they need high bandwidth, low latency, or both?

Compression

Compression allows us to reduce the number of bits needed to represent data, for the purpose of reducing file size. This is very beneficial in networking, as less bandwidth will be required to transmit the data over a network.

There are two major types of compression. These are:

- **Lossy Compression** – It permanently deletes certain bits of data to reduce file size. The file cannot be decompressed to restore it to it to its original form.
- **Lossless Compression** – It uses algorithms to pack the data into less space. The files can be decompressed to restore them to their original form.

Both of these two types of compression have their own applications and implications.

Lossy Compression

- Advantages
  - File sizes are reduced much more using lossy compression than lossless. This is helpful if you’re transmitting online, such as via email, to ensure quicker upload & download times.

- Disadvantages
  - Compressed files are of a reduced quality and can never be restored to their original high quality. If you’re sending the file for professional printing, or for assessment, quality is important and so lossless compression may be preferable.
  - Video compression uses a CODEC which the person receiving the file may not have installed which would prevent them from being able to watch the video on their computer.
  - Sometimes when compressing files, particularly audio & video files, the file cannot be compressed further and so compressing the file can actually increase the file size. This will make it take longer to receive the file when transmitting online.

Lossless Compression

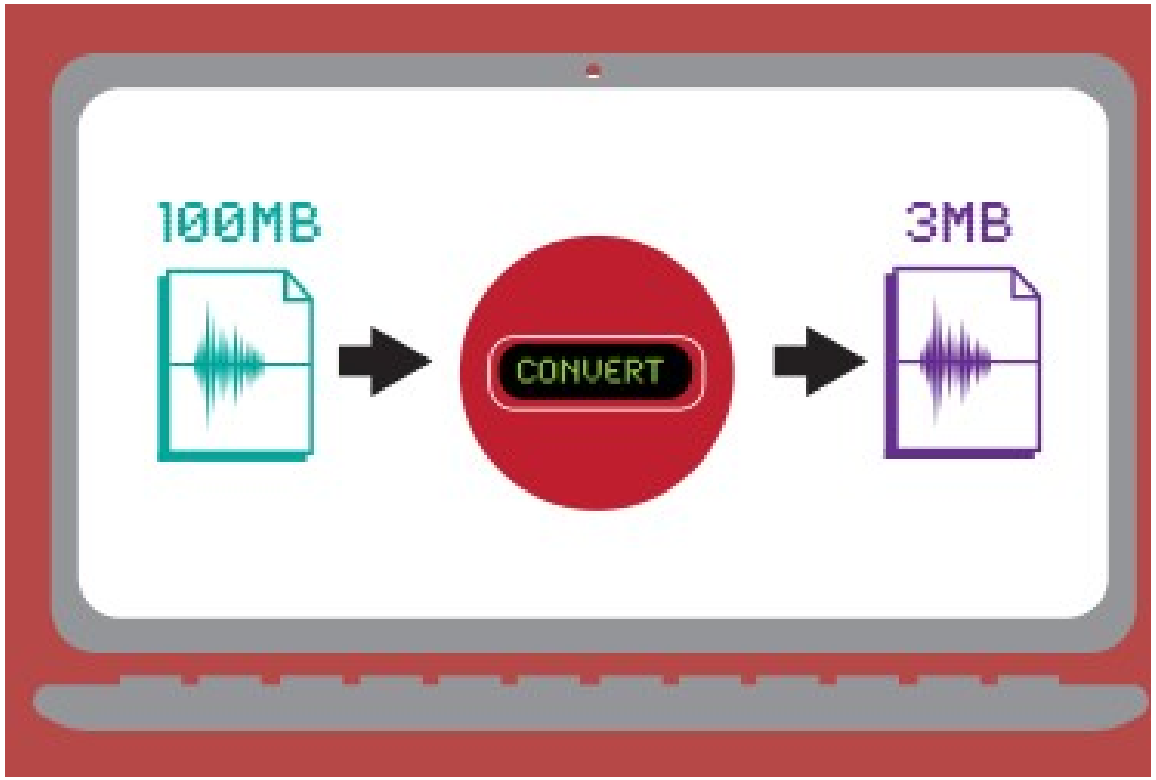
- Advantages
  - Files can be decompressed back to their original quality. This means you do not need to compromise the quality of your work just to distribute files online. E.g. a photographer sending his pictures to a client will want to keep quality high even when sending via email.

- Disadvantages
  - Compressed files can be incorrectly identified as malware by anti-virus software and block the files, preventing any recipients from accessing them.
  - File archive compression formats often only work with specific archive software. If the format isn’t compatible with the recipient’s software then the file will need to be resent in a different format.
  - Decompressing files can take significant processing time and memory which can cause the computer to slow down and lag.
  - Much like with lossy compression, when compressing files, if the file cannot be compressed further then the compression can actually increase the file size.

Compression Activity

What type of image formats use lossy compression and what formats use lossless compression?

Research this online.



Codecs

Hardware CODECs

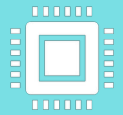
A hardware CODEC is used to encode analogue data (which computers cannot store or use) into digital data (which they can). It will then decode the digital data into an analogue form.

An example would be a soundcard. It encodes your voice, such as when using a microphone, so that the computer can store and transmit your voice. It then decodes it so that the data can be played and listened to via speakers or headphones.

This is important for certain applications of networking, such as VoIP. If we want to have VoIP conversation we need to be able to input our voice into our computer so it can be transferred to the person we are speaking to. We also need the computer to be able to output sound so we can hear the person we are speaking to.

Codecs

Software CODECs



A software CODEC is used with audio and video data in order to compress the data so that it can be transmitted over a network. Audio and video data is often large and so compressing it is important to ensure it can transmit over the network quickly enough to be viewed/listened to without lots of skipping.

Again, this is very important in VoIP as you need to be able to send the audio and video data quickly enough to hold a real-time conversation. It is also used in music and video streaming services though, to allow for you to play these without excessive buffering leading to the movie/song constantly pausing.

One downside to CODECs is that there is a wide variety of CODECs that are used which can lead to problems with compatibility. To listen to audio (or watch video) that has been encoded using a CODEC your computer needs to have the same CODEC to decode it.

Codec Activity

Do CODECs use lossy or lossless compression? Or are there both lossy and lossless CODECs?

Research this online.

Data Transmission Issues - Summary

- The bandwidth of a network is the amount of data that can be transferred from one computer to another in a given period of time.
- The latency of a network is a measure of the time it takes for a data packet to transfer over a network.
- Online gaming requires a low latency due to the quick response time needed, however it doesn't need a large bandwidth.
- Online streaming requires a large bandwidth due to the amount of data that is transferred, however it doesn't need a low latency.
- Compression is used to reduce the size of files. This is helpful in networking as it means we need less bandwidth to transfer a file.
- Lossy compression permanently deletes certain bits of data to reduce file size. It is commonly used in video, audio & image compression.
- Lossless compression uses algorithms to pack the data into less space. It is commonly used in document compression.
- Lossy compression reduces the quality of a file and cannot be decompressed back to its original quality. Lossless compression cannot reduce the file size as much as lossy.
- Hardware CODECs are used to encode analogue data into digital data. It will then decode the digital data into an analogue form.
- Software CODECs are used with audio and video to compress the data so that it used transmitted over a network.
- A downside to CODECs is that there can be compatibility issues due to the variety of CODECs available.